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UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA, SAN FRANCISCO DIVISION

WAYMO LLC,
Plaintiff,
vs.
UBER TECHNOLOGIES, INC.; OTTOMOTTO LLC; OTTO TRUCKING LLC,
Defendants.

CASE NO. 3:17-cv-00939

DECLARATION OF PIERRE-YVES DROZ

UNREDACTED VERSION OF DOCUMENT FILED UNDER SEAL

I, Pierre-Yves Droz, hereby declare as follows.

1. I have been employed by Waymo LLC ("Waymo"), and before that, Google Inc. ("Google") since October 2011. My current title is Principal Hardware Engineer, and I have been the technical lead on Waymo's LiDAR project since its inception. I make this declaration in support of Waymo's Motion for a Preliminary Injunction and have personal knowledge of the facts stated herein.

2. I received a Masters degree in engineering from the Ecole Polytechnique in Paris, France in 2005, and a Masters degree in Electrical Engineering and Computer Science from the University of California, Berkeley in 2005.

A. My Early Development of LiDAR Systems

3. In 2006, I co-founded a company, along with Anthony Levandowski and Andrew Schultz, that was eventually called 510 Systems, LLC ("510 Systems"). I worked full time at 510 Systems, and my role included, among other things, principal responsibility for research and development (analogous to the role a Chief Technology Officer would have at a larger company). Mr. Levandowski was leading the company on a part-time basis, providing input on major strategic decisions, with less involvement with day-to-day operations.

4. In 2009, 510 Systems began [redacted] Project Chauffeur, the internal name of Google's self-driving car project. [redacted]

5. In April 2010, 510 Systems started developing an in-house LiDAR solution, as opposed to using purely third-party vendors, such as Velodyne. LiDAR stands for Light Detection And Ranging, and uses the principles of radar but using laser beams instead of radio waves: LiDAR shoots beams out into an environment, where objects reflect the beams back into the LiDAR, such that the LiDAR can measure the time it took for the laser beams to come back and figure out how far away an object is. I led our company's efforts toward our in-house LiDAR solution, and by December 2010 we had a prototype we code-named "Little Bear" (sometimes shortened as "LBr"):

6. Little Bear, which was named for a mountain in Colorado following 510 Systems' practice of naming products after mountains, was mostly a [redacted] LiDAR that [redacted] and was thus not usable for autonomous driving without human intervention. (This is in contrast to, for example, Waymo's current-generation mid-range LiDAR systems, which [redacted] and can thus be used for autonomous driving without human intervention.)

7. In early summer 2011, after the success of Little Bear, we decided to develop LiDAR systems for self-driving applications, [redacted] At the time, self-driving projects including Google's used commercially available LiDAR systems from Velodyne. However, because of [redacted] that we learned from our experience with Little Bear, we decided to develop a LiDAR system for long ranges and a separate LiDAR system for medium ranges. I came up with the idea of naming our different LiDAR versions after bear names to follow the original Little Bear LiDAR, and we named our long-range LiDAR "Papa Bear" (or "PBr") and our mid-range LiDAR "Mama Bear" (or "MBr").

8. In July 2011, Google acquired 510 Systems, and I became a Google employee in October of that year. My initial role was technical lead of the LiDAR team, and I have maintained this role throughout my time at Google and now Waymo.[1] The LiDAR team has grown consistently over the last five plus years, from 6 people when Google acquired 510 Systems to approximately [redacted] people today.

B. Development of Waymo's LiDAR Systems

9. Designing and developing LiDAR systems is a difficult process. Using LiDAR for a self-driving car requires that the LiDAR system be capable of satisfying numerous self-driving car test scenarios, such as [redacted]. Doing so is difficult, as [redacted]. As discussed above, early on, we realized that we would need different LiDAR designs for different ranges.

10. In particular, for long ranges, [redacted]. At 510 Systems, an early idea we had for Papa Bear involved [redacted]. From our experience trying to do this both at 510 Systems and after we joined Google, we discovered that this solution did not work. We also learned other designs to avoid, such as [redacted] Another early lesson learned was [redacted]. Finally, after building several different prototypes of Papa Bear, the first one we equipped our fleet with (in [redacted]) was version 5, which was [redacted] After

[1] In this declaration, I use Google and Waymo interchangeably, understanding that the Chauffeur self-driving car project at Google became its own separate company, Waymo, late last year.

driving hundreds of thousands of miles with this LiDAR, however, we discovered new self-driving car scenarios that could not be satisfied with it. For example, [redacted]. We thus iterated more designs of Papa Bear, eventually settling on a version with a 360 degree field of view, which Waymo still uses on its self-driving fleet given the lack of viable alternatives for long-range LiDAR.

11. Concurrently with our design and development of Papa Bear, we also worked on developing a mid-range LiDAR. Beginning in early summer 2011, we worked on the Mama Bear design, which [redacted]. After more than a year of hard work, however, this design proved not to be viable for use in self-driving cars. In particular, though [redacted] seemed at the outset like a useful solution for self-driving LiDAR systems, problems with [redacted] that could not have been foreseen in advance and that could not, after months and months of development, be fixed. Through all these troubles, Anthony Levandowski was involved and supportive of our team continuing to work on the Mama Bear design. However, the issues with Mama Bear made it impossible to [redacted] needed for self-driving cars. In late 2012, we decided to abandon Mama Bear and come up with an entirely new design for a mid-range LiDAR, codenamed "Grizzly Bear" (or "GBr").

C. Waymo's Innovative Mid-Range LiDAR Design

12. Beginning in December 2012, Waymo began devoting many resources into developing our mid-range Grizzly Bear LiDAR. Though certain Little Bear and Mama Bear elements were adopted for GBr (such as [redacted]), GBr was a very different design than anything we or anyone else had previously done. The GBr design was made possible given all the know-how and technological capabilities my team had developed over several years of working on LiDAR systems, including LBr, PBr, and MBr. In contrast to commercially available LiDAR systems, such as the Velodyne system originally used by 510 Systems and previously Project Chauffeur, GBr had many advantages. It was [redacted]

[redacted]

13. One of GBr's innovations was a design that, in part, used a single lens—rather than multiple sets of lenses—to both transmit and receive the collection of laser beams used to scan the surrounding environment.

14. Traditionally, a LiDAR system used lens assemblies with multiple elements (such as 3 lens elements—or a triplet lens—for transmit side and another triplet lens for the receive side), but this approach was not practical in a LiDAR system meant for self-driving cars because the size and cost of the system would be very large due to the complexity of manufacturing numerous complex lens elements. Another option that Velodyne actually used was putting multiple singlet lenses next to each other. However, this required using two separate lenses for two separate sets of beams, thereby splitting the field of view of the LiDAR into two separate fields of view, slightly getting around the problem of handling multiple beams but not significantly decreasing the cost or size of the system. (Velodyne's 64-beam LiDAR previously used by Google costs over $70,000, well above the cost of most cars.)

15. A key insight we had at Waymo was that using one lens for both transmit and receiving is simpler and allows for a smaller and less expensive LiDAR unit. Using one lens better ensures that focal lengths are equal for both sending laser beams out (transmit side) and for receiving reflected light back (receive side) so that the transmit and receive arrays can match perfectly. If the two arrays don't match, they would not line up and you would only be able to align a few channels, making all others channels useless for detection. Waymo first pioneered a single-lens design in GBr. While using a multiple-element lens in a LiDAR makes the focal plane flat like a pancake rather than curved like a bowl, complicating the optical layout, we developed

many innovations to deal with the curved focal plane that allowed us to get the small-size and low-cost benefits of a single-lens system.

16. I was one of the primary people who conceived and developed the single-lens design concept. This design greatly simplified the manufacturing process by eliminating the need to painstakingly align pairs of transmit and receive elements, with even a slight miscalibration would significantly affect the accuracy of the system. Waymo was awarded a patent on its design in 2014: United States Patent No. 8,836,922 ("the '922 patent"), entitled "Devices and Methods for a Rotating LiDAR Platform with a Shared Transmit/Receive Path." I am a named inventor on this patent. My colleagues at the time, Anthony Levandowski, Gaetan Pennecot, and Daniel Gruver were among the other named co-inventors. I understand that all now are employed by Otto/Uber.

D. Perfecting GBr for Use in Self-Driving Cars

17. With the goal of making this new design accurate and robust enough to use on self-driving cars, Waymo's LiDAR Team continued to invest resources into developing its LiDAR systems over several months. In [redacted], Waymo rolled out the second generation of its proprietary mid-range LiDAR—GBr2. Again, compared to off-the-shelf solutions, the GBr design (as refined in GBr2), was groundbreaking. It dramatically reduced the cost and size of the LiDAR system while increasing resolution and performance for self-driving vehicles. To get to this point, it had taken us nearly two years from when we first set out to build a mid-range LiDAR accurate and robust enough to provide the data required for a car to drive itself and thus to replace the Velodyne LiDARs we used at the time.

18. Development of GBr2 required solving innumerable issues. For example, we discovered that [redacted]. I spent a lot of effort to trace the issue over three months to figure out that the issue was caused by a [redacted]. After finally figuring out what caused the [redacted], we were able to fix it by [redacted]

[redacted]. Issues like these are something a LiDAR designer not previously familiar with Waymo's designs could not foresee in advance.

19. Through our many months of design and development, we finally had a successful and cost-effective mid-range LiDAR for self-driving cars. We finally switched from off-the-shelf Velodyne LiDAR systems to our in-house GBr2 LiDAR [redacted], almost three years after we first set out to do so (beginning with Mama Bear) and approximately a year after we first came up with the single-lens concept for Grizzly Bear.

E. Waymo's Current-Generation Mid-Range LiDAR

20. Waymo's current-generation mid-range LiDAR, known internally as GBr3, builds on the same foundation as GBr and GBr2 but adds other innovations, such as [redacted]. These arrangements are specifically designed—based on Waymo's years of testing, simulation, experimentation, and optimization for different test scenarios—for use in self-driving cars. Thanks to these unique designs, GBr3 [redacted]. Yet implementing these designs was not easy. As one example of the difficulty of implementing GBr3's design, Waymo had to [redacted]).

21. This [redacted] Instead of using [redacted], the GBr3 design [redacted]. This was possible only by using the insights that [redacted]

[redacted]. In this way, the GBr3 design improves [redacted].

22. Further, that [redacted] is only the beginning of the solution. To determine [redacted] takes enormous time, simulation, and resources. [redacted]. Among other things, this development required [redacted]

F. Waymo's Current-Generation Short-Range LiDAR

23. In 2013, we noticed a problem with [redacted] of the Velodyne LiDAR then in use. To solve this problem, we designed and developed a very simple short-range LiDAR system [redacted], codenamed Teddy Bear ("TBr"). Waymo's fleet now uses four TBr LiDAR units on each car to cover the main mid-range LiDAR unit's blind spots very close to the car.

G. Confidential Files Downloaded by Mr. Levandowski

24. I understand that Mr. Levandowski may have downloaded 14,000 design files contained in the SVN repository containing circuit design schematic files for all of Waymo's projects. Over 4,000 of these files are related to Waymo's LiDAR designs, including each and every design discussed above. For example, files found at the following file path: [redacted] provide the detailed specifications, including positioning and alignment of all elements on [redacted]. Similarly, [redacted] contain the detailed specifications, including positioning and alignment of all elements on the GBr3 receive board. But the SVN repository downloaded by Mr. Levandowski contains all highly confidential and proprietary circuit specification and design files for *every* product developed at Waymo, including [redacted], and many others, as well as the specifications for circuits [redacted].

25. I also understand that Mr. Levandowski may have downloaded additional files from Waymo servers from November 2015 to January 2016, shortly before his departure, including "Chauffeur TL weekly updates - Q4 2015_[redacted].xlsx," which I am familiar with from my work. They are attached as Exhibits A-I to this declaration. Each of these documents reflects confidential, proprietary information on how Waymo designs and implements its LiDAR systems.

26. For example, the "TL weekly updates" document is a collection of information from technical leads from the entire self-driving team, detailing what they are doing each week, the problems they are running into and eventually, the solutions they come up with. This type of information would be highly beneficial information for a competitor looking to implement a self-driving car. As one example, the weekly updates include very specific risks with respect to the various LiDAR systems being developed at Waymo, which could help a competitor in knowing what issues to design around early on, before they become problems, and what issues turn out not to be obstacles to the use of LiDAR systems for self-driving cars. One specific example of such a risk identified in this document was [redacted]

[redacted]. Another specific example, [redacted]. We solved this issue by [redacted] It would have been impossible to know in advance that [redacted] would cause the issues [redacted], nor could we have known the solution to these issues in advance. Having this knowledge would allow a competitor to save time, money, and effort that would otherwise have been spent addressing the various risks encountered during LiDAR design and development.

27. Mr. Levandowski personally told me in January 2016 he was interested in implementing long-range LiDAR at his new company and was thus interested in the PBr design, which is not available in any commercially available LiDAR system that I know of. I distinctly remember taking a walk around our Mountain View office one-on-one with Mr. Levandowski on or around January 5, 2016. During this walk, he told me specifically that he wanted his new company to have a long-range LiDAR, which is very useful for self-driving truck applications he was interested in. He also told me that he planned to "replicate" this Waymo technology at his new company.

28. This conversation did not surprise me. Mr. Levandowski had previously told me, in or around the summer of 2015, that he had talked with Brian McClendon, an Uber executive involved with their self-driving car project. We were having dinner at a restaurant near the office, and he told me that it would be nice to create a new self-driving car startup and that Uber would be interested in buying the team responsible for the LiDAR we were developing at Google.

29. Later in January 2016, a colleague told me that Mr. Levandowski had been seen at Uber's headquarters in mid January. I asked Mr. Levandowski about this, and he admitted he had met with Uber, and the reason he was there was that he was looking for investors for his new company.

H. Waymo's LiDAR Trade Secrets Are Protected

30. Waymo takes robust measures to protect its LiDAR trade secrets. As a condition of employment, I understand Waymo requires all employees—including members of the LiDAR team who have left Waymo to work for Defendants—to enter into written agreements to maintain the confidentiality of proprietary and trade secret information, and not to misuse such information. In addition, Waymo enforces an employee code of conduct that explains employees' strict obligations to maintain the secrecy of confidential information.

31. For example, employees are required to complete annual information security training. I understand that Waymo tracks whether I have completed the training (and re-training) on an annual basis.

32. Waymo also employs network security measures and access policies that restrict the access and dissemination of certain confidential and proprietary trade secret information to only teams that are working on projects related to that information. For example, Google employees working on projects with no relation to Waymo or self-driving cars could not (and cannot) access Waymo's confidential and proprietary schematics (e.g., the "SVN" repository). They are distributed on a "need to know" basis.

33. Networks hosting confidential and proprietary information include numerous safeguards, such as encryption, passwords and dual-authentication.

34. Waymo also takes reasonable measures to mark confidential and proprietary information, such as documents and other materials, with visible legends designating them as such when sharing them outside of Waymo (subject to NDAs).

35. Waymo employs reasonable efforts to secure physical facilities by restricting access and employing locks, cameras, guards, and other security measures.

36. In my experience, Waymo also requires consultants, vendors, and manufacturers to sign confidentiality agreements that require that they undertake reasonable efforts to maintain, and not to disclose, any confidential or trade secret information.

37. Though sharing technical information with vendors is sometimes necessary, Waymo closely guards and never discloses our LiDAR systems' overall specifications (such as the

[redacted], or similar specifications of each of our systems), or our desired target specifications to satisfy different self-driving test scenarios, to any vendors, even under an NDA.

I. Potential Harm to Waymo

38. Google and now Waymo has spent an enormous amount of time developing its self-driving car technology, including its custom-built LiDAR systems. In my team alone (now a team of approximately [redacted] people), we've spent 5-7 years working on our LiDAR designs to get to our current-generation design, GBr3. This has included Google and Waymo spending several millions as well as thousands of hours of time. I personally have the last six years working almost entirely on custom LiDAR solutions for self-driving cars.

39. Our current design, GBr3, reflects these years and millions of dollars of research and development that no one else in the industry has access too. Waymo is unique in the industry in its long history researching and pioneering LIDAR designs for self-driving cars. This is one reason that I believe Waymo is the industry leader in self-driving cars.

40. For example, and as discussed above, our development time (while still ongoing in some respects) took the team about six months to develop the GBr3 design even with the GBr2 design already done (and three years after we first started working on our original mid-range LiDAR, MBr). Also as discussed above, GBr3 provides a number of benefits not present in the GBr2 design or disclosed in our patents, including being less expensive for better resolution, a smaller design, more robust—all important criteria for self-driving cars.

41. In my opinion, the self-driving car market is a nascent market in which the cost and energy required to deploy at large scale in a new region are significant. The growth, profitability, and even survival of individual companies will likely be determined by what happens in the next few years. If another company, such as Otto/Uber, were to use Waymo's intellectual property, I believe that would greatly harm Waymo during this embryonic market formation process by providing direct competitors with essentially a multi-year "head start" in their development of self-driving car technology.

I declare under penalty of perjury that the foregoing is true and correct. Executed in Mountain View, California, on March 9, 2017.

DATED: March 9, 2017

Pierre-Yves Droz